

CNS

Doctor 2021



Anatomy Sheet (6)

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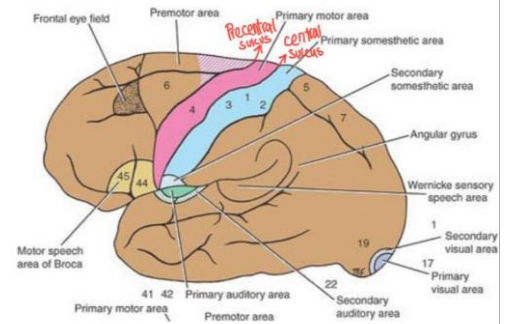
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Frontal lobe (motor lobe):

- The precentral area

- **The posterior region:** motor area, primary motor area, or Brodmann area 4, occupies the precentral gyrus extending over the superior border into the paracentral lobule.



Note: the paracentral lobule it is the one that is close to the longitudinal fissure.

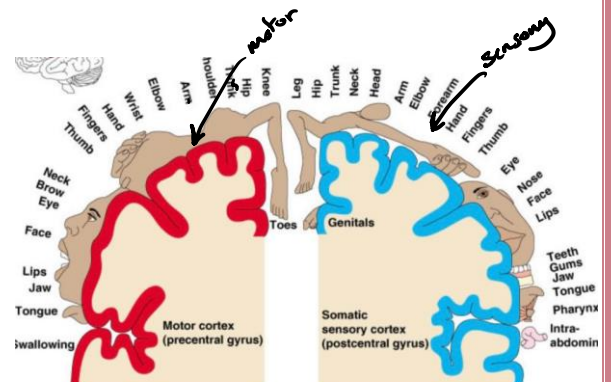
There's a sulcus running parallel to the central sulcus (precentral sulcus). The region between these two sulci is the precentral gyrus, anatomically speaking.

Functionally, it's referred to as the primary motor area, area #4 in Brodmann's division. This area, the most posterior portion of the frontal lobe, serves as **the final execution point for movement**—a conversion of design into action. The precentral gyrus which contains the UMN cell bodies sends out the pyramidal tract, specifically the corticospinal tracts, to the anterior horn cells in the spinal cord.

- isolated movements on the opposite side of the body
- The area of cortex controlling a particular movement is proportional to the skill involved in performing the movement.
- The primary motor cortex is not responsible for the design of the pattern of movement but is the final station for conversion of the design into execution of the movement.

This is a homunculus of the body, each part of the body is represented in the cortex (the lower one quadrant of the cortex represents the head and neck area, which is further away from the longitudinal fissure and it sends fibers of UMN to nuclei in the brain stem which is responsible of the movement of the head and neck muscles)

We also know that we have decussation in which the right side of the cortex controls the left side and vice versa. Plus, the size isn't proportional to the representation in cortex (the complexity and the number of receptors is related to representation).



Premotor region

- **The anterior region:** the premotor area, secondary motor area, or Brodmann area 6 and parts of areas 8, 44, and 45. It occupies the anterior part of the precentral gyrus and the posterior parts of the superior, middle, and inferior frontal gyri.

- Store programs of motor activity assembled as the result of past experience.
- Programs the activity of the primary motor area.
- Involved in controlling coarse postural movements.
- Receives numerous inputs from the sensory cortex, the thalamus, and the basal ganglia
 - The key differentiator between area 4 and area 6 lies in the symptoms of lesions.
- Destruction of the primary motor area (area 4) produces more severe paralysis than destruction of the secondary motor area (area 6). typically result in UMN lesion paralysis
- Lesions of the secondary motor area alone produce difficulty in the performance of skilled movements, with little loss of strength. So, if we have a lesion in area 6, he can move however he can't do precise movements like putting a thread into needle.

Frontal eye field

- Location: extends forward from the facial area of the precentral gyrus into the middle frontal gyrus (parts of Brodmann areas 6, 8, and 9).
- Function: control voluntary scanning movements of the eye and is independent of visual stimuli

This area is important for conjugating eye movements. Coordination is important in these complex eye movements, For example, when both eyes move in the same direction, specific eye muscles contract and relax accordingly.

NOTE: focus on the word independent of visual stimuli because we'll discuss next an area in the occipital lobe know as occipital eye field area that is dependent on visual stimuli.

- the patient looks away from the irritation but toward the destruction

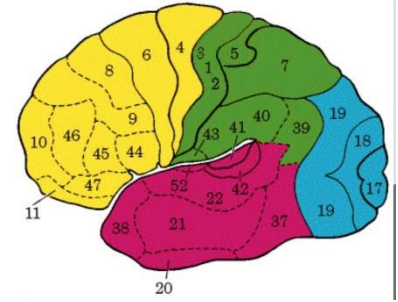
Note : The left side of the brain is responsible for moving the eyes to the right and vice versa

If we have a destructive lesion on the right side of the brain, both eyes will move towards the right. However, irritation causes excitation (unlike destruction). So, IRRITATION on the right side of the brain causes both eyes to move to the left.

Motor speech area of Broca

- location: inferior frontal gyrus between the anterior and ascending rami and the ascending and posterior rami of the lateral fissure (Brodmann areas 44 and 45)

- **Function: formation of words by its connections with the adjacent primary motor areas**



Speech involves two stages:

1. **comprehension (sensory-Wernicke's area): to understand of spoken and written words**
2. **expression (motor-Broca's area): formation of words, word formation is considered highly skilled motor activity.**

PREFRONTAL CORTEX:

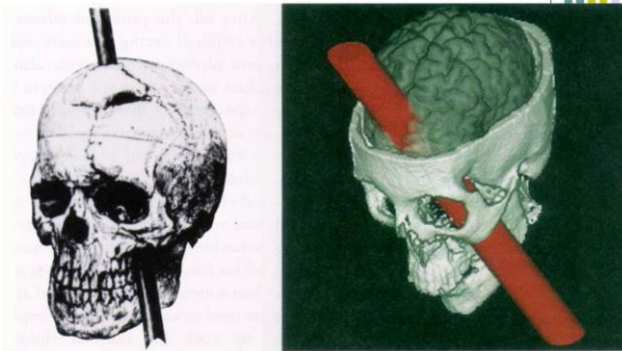
- **Location: anterior to the precentral area. It includes the greater parts of the superior, middle, and inferior frontal gyri; the orbital gyri; most of the medial frontal gyrus; and the anterior half of the cingulate gyrus (Brodmann areas 9, 10, 11, and 12)**

FUNCTION:

- **Individual's personality.**
- **Regulator of the person's depth of feeling.**

Last area we'll discuss in frontal lobe is prefrontal cortex (the most anterior part which contains areas 9-12)(the highest area in cortex)

Phineas Gage



The best way to explain its function is talking about the famous story Phineas cage: شخص عاش في ١٨٠٠ كان يشتغل بسكك الحديد، وكانوا زمان يوفروا وقت بالحفر ما كانوا يحفروا بالأدوات التقليدية، كانوا يفجروا وبصير في حفر كبيرة من خلال الديناميت، هو عامل عادي كان يعمل بهاي المهنة وصار معه حادث مشهور، يلي صار هو انه قضيب حديد بفعل الانفجار خبط فيه ودخل بالطريقة هي ضل عايش بس صار في تغيرات (it entered below the zygomatic arch in the anterior cranial fossa and it took the prefrontal lobe) بشخصيته وزملانه انتبهوا انه شخصيته تغيرت بعد الحادثة **This concept of personality change due to a lesion was groundbreaking at the time (he used to be nice then became rude after the lesion)**

Prefrontal cortex (most anterior part)

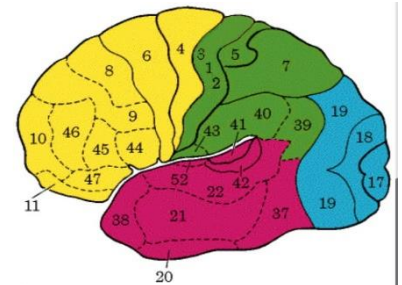
- **Location:** anterior to the precentral area. It includes the greater parts of the superior, middle, and inferior frontal gyri; the orbital gyri; most of the medial frontal gyrus; and the anterior half of the cingulate gyrus (Brodmann areas 9, 10, 11, and 12)
- **Function:**
 - Individual's personality.
 - Regulator of the person's depth of feeling

Prefrontal cortex helps you to fit in society تكبت الغرائز الأساسية لدى الانسان ومرات يكون عندك قناعات ما بتحكيها. مثلا بتحس زميلك لاسمح الله بملك صفة سلبية يكون نفسك تكون صريح وتحكيها بس مارج تحكيها بوجهو ولو انت مقتنع فيها لان مش مقبول وبتصنفه الناس على انه وقح وبتعرضه لمشاكل.

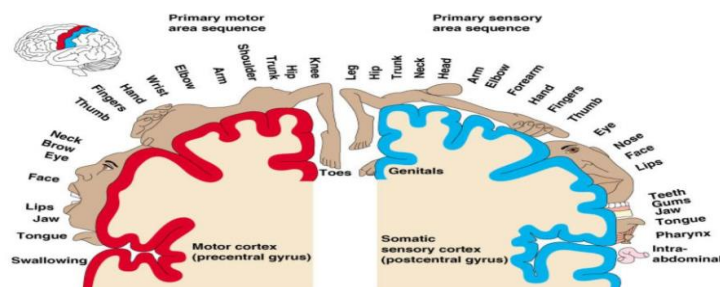
Note: frontal lobe is a motor lobe but its proved that its more than motor lobe , it is executive lobe which is more general than motor lobe , motor >> when you design movement { coordination }Executive lobe >> when you design your life , when you respect traditions , planning. Prefrontal lobe makes frontal lobe more like an executive lobe rather than motor lobe.

✓ Parietal Lobe (posterior to central sulcus(green area))

- **Primary somesthetic area (primary somatic sensory cortex S1):**
- **Location:** postcentral gyrus on the lateral surface of the hemisphere and the posterior part of the paracentral lobule on the medial surface (Brodmann areas 3, 1, and 2)

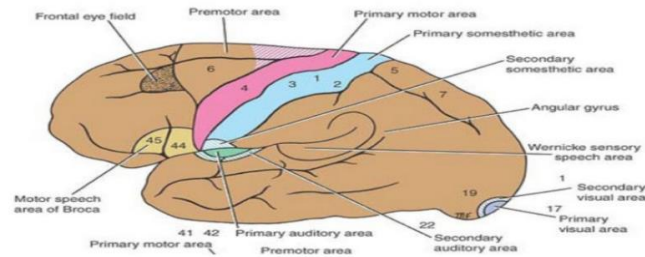


We have talked about this area in sensory tracts: (PCML & ALS) PCML: discriminative touch, conscious proprioception, 2 point discrimination/ALS: pain, temperature and crude touch. Area 3,1,2>>primary somatic sensory cortex s1 which is anatomical located postcentral gyrus, it has homunculus which means each area in the body is represented in the cortex and this presentation is not proportional to the size, its proportional to number of receptors.



✓ Primary somatic sensory cortex S1

- The size of the cortical area allocated to each part of the body is directly proportional to the number of sensory receptors present in that part of the body.



✓ Secondary somesthetic area (secondary somatic sensory cortex S2)

- Location: superior lip of the posterior limb of the lateral fissure
- Function: transient cutaneous stimuli, such as brush strokes???

Its function is still questionable. (الدكتور حكى مش كثير مهمة)

✓ The somesthetic association area Important!

- Location: superior parietal lobule extending onto the medial surface of the hemisphere (Brodmann areas 5 and 7) ز
- Function: not only receives information concerning the size and shape of an object but also **relates this to past sensory experiences**.
"recognize objects placed in the hand".

- Function:
 - STEREOGNOSIS: recognize objects placed in the hand"
 - GRAPHESTHESIA: recognizing a written number or letter traced on the skin
 - BAROGNOSIS: ability to sense weight

Note: primary somesthetic area (3,1,2) responsible for

primitive sensation without analysis while analysis to what you are touching is the association area.

مثال من الدكتور: اذا مديت ايدك في جيب زميلك انت لخالك رح تعرف في مفتاح رغم انك ما شفته بس من احساسك رح ترسم صورة **without vision** (second level of analysis).
المفتاح بذهنك

- Graphesthesia example:

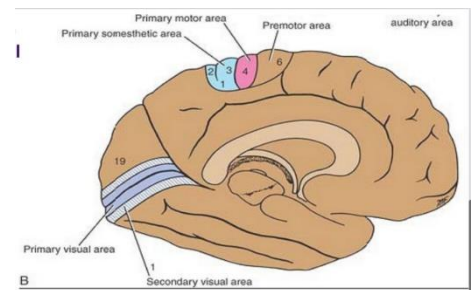
لو زميلك بيكتب على ايدك حرف ال O

بدون ما تشوف, بسهولة رح تعرف انه هاد هو الحرف.

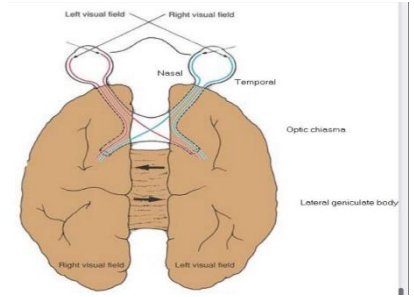
✓ Occipital lobe Primary visual area

Most posterior , It's nick name is visual lobe.

- Location: the walls of the posterior part of the calcarine sulcus and may extends around the occipital pole onto the lateral surface of the hemisphere (Brodmann area 17)



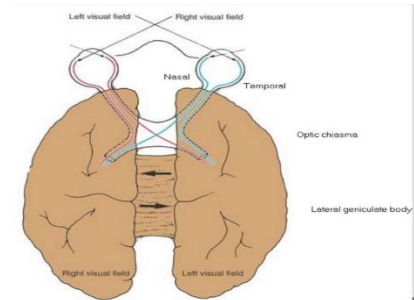
The main area of it its area n17 which is the end of visual pathway . The retinal surface of the eye is concave, with a medial nasal half and a lateral temporal half, nerve fibers from the **temporal half go ipsilaterally** and fibers from the **nasal half cross the midline forming** the optic chiasm, but how does this affect visual information reaching the occipital lobe? Looking at light rays coming from the left side of the visual field, light rays hit the temporal area of the right eye and the nasal area of the left eye, both of these areas send fibers to the right occipital lobe, so our **left visual field is represented on right occipital lobe, and oppositely our right visual field is represented on the left occipital lobe.** In a way our vision is comparable to other senses, touch on the right side of the body is perceived by the left hemisphere and our right visual field is perceived by the left hemisphere.



- Upper visual area represents below calcarine sulcus and lower visual area above calcarine sulcus .

Occipital lobe primary visual area

- **Function:** receives fibers from the temporal half of the ipsilateral retina and the nasal half of the contralateral retina. The right half of the field of vision is represented in the visual cortex of the left cerebral hemisphere and vice versa.



✓ The secondary visual area

- **Function:** relate the visual information received by the primary visual area to past visual experiences, thus enabling the individual to **recognize and appreciate** what he or she is seeing . not only past visual experience but also other sensory experiences .
- **Occipital eye field:** reflex and associated with movements of the eye when it is following an object. (dependent on visual stimuli). we compare it with frontal eye field which is responsible for voluntary scanning movement independently on visual stimuli .

Temporal lobe (located in inferior lateral fissure) =auditory lobe

✓ Primary auditory area: (cortex)

- **Location:** (Brodmann areas 41 and 42) inferior wall of the lateral sulcus. Orientation is tonotopic (related to tone and frequency) so that make us to detect different auditory inputs.
- **Anterior part:** sounds of low frequency
- **Posterior part:** sounds of high frequency

✓ Secondary auditory area:

- **Location:** posterior to the primary auditory area in the lateral sulcus and in the superior temporal gyrus (Brodmann area 22) (surround primary auditory)
- **Function:** necessary for the interpretation of sounds and for the association of the auditory input with other sensory information. (second level of analysis)

✓ Sensory speech area of Wernicke:

- **Location:** in the superior temporal gyrus, with extensions around the posterior end of the lateral sulcus into the parietal region.
- **Function:** permits the understanding of the written and spoken language and enables a person to read a sentence, understand it, and say it out loud.

The vestibulocochlear nerve (CN VIII) consists of the vestibular and cochlear nerves. The vestibular nerve is primarily responsible for maintaining body balance and eye movements, while the cochlear nerve is responsible for hearing. The cochlear nerve enters the brainstem through pontomedullary junction and there were two nuclei anterior cochlear nucleus and posterior cochlear nucleus then neurons crossing midline + trapezoid body they ascend forming lateral lemniscus. The lateral lemniscus is part of the auditory tract of the brainstem and pass through inferior colliculus and medial geniculate body but in visual system it pass through lateral geniculate body. (All sensory system don't pass cortex directly they rely first in thalamus then go to the cortex). In sensory system they rely in VPL nucleus in thalamus then go to s1.

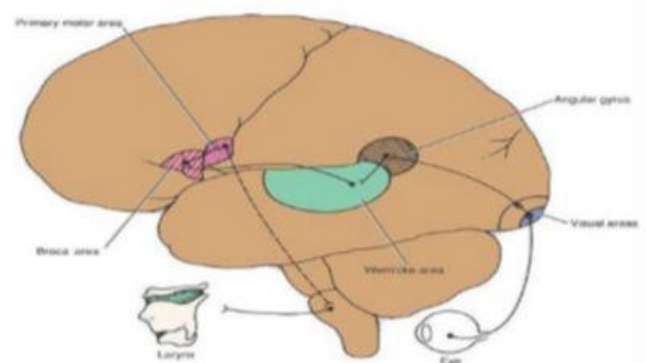
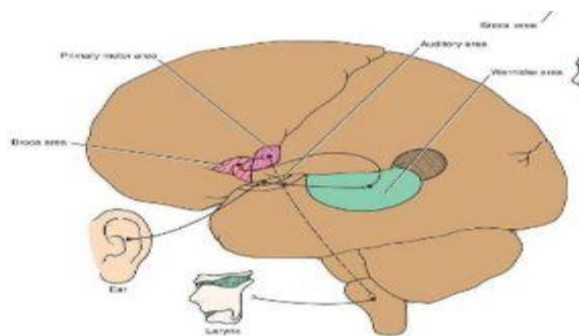
-Trigeminal system rely in VPM nucleus in thalamus.

-Visual system (lateral geniculate body).

-Auditory system (medial geniculate body).

✓ Clinical notes:

- **Expressive aphasia:** Destructive lesions in the left inferior frontal Frontal Gyrus (Broca's) (Motor speech area)
- **Receptive aphasia:** Destructive lesions restricted to the Wernicke speech area (comprehension part)
- **Global aphasia** Destructive lesions involving both the Broca and Wernicke speech areas.



-Left picture represent processing when you hear a question and you want to answer it, so it starts in the cochlea in inner ear - cochlear nerve -lateral lemniscus and medial geniculate body - primary auditory cortex then secondary auditory. رح تقلك انه كلام منطوق من انسان

Then comprehension will happen which is connection between auditory cortex with Wernicke area this connection will make us to understand شو الكلام المنطوق. Then another connection will happen between sensory speech area with motor speech area this connection will make coordination for proposed movement which is to move tongue, larynx, and lips then to primary motor cortex (lower one quadrant related to speech muscles such as larynx and tongue muscles). Then to upper motor neuron that will give response to the nuclei in the brain stem for example nucleus ambiguus that is responsible for muscles movement of larynx.

-Right picture represent the mechanism when you read a sentence out loud its start in the retina - lateral geniculate body - primary visual cortex then to secondary to appreciate what you are seeing - angular gyrus which help you to analyze written words - wernicke area which has a connection with motor speech area same as when you want to answer a question.

CLINICAL DOCTOR'S NOTES:

-Aphasia: عدم القدرة على النطق

-Expressive aphasia: صعوبة في تكوين الكلمات.. رح تفهم شو بيحكى ولكن بصعوبة..

-Receptive aphasia: FLUENT...لا يوجد صعوبة في النطق.. ولكن الكلام مش منطقي..

-Destructive lesions in the angular gyrus in the posterior parietal lobe Produces:

- 1-Alexia: inability to understand written words.
- 2-Agraphia: loss of writing ability.

✓ **The taste area:** primary gustatory cortex

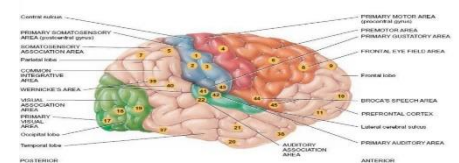
- Situated at the lower end of the postcentral gyrus (parietal lobe) in the superior wall of the lateral sulcus and in the adjoining area of the insula (Brodmann area 43).

- 1) Facial nerve anterior two-thirds of the tongue.
- 2) glossopharyngeal nerve posterior third of the tongue.
- 3) Vagus nerve which provides fibers to the epiglottis region.

These three cranial nerves when go to brain stem they have same relay station which is nucleus tractus solitarius (solitary nucleus) in the central gray matter just underneath floor of fourth ventricle. The fibers from solitary nucleus will ascend to nucleus in the thalamus which is VPM (ventral posteromedial nucleus) that receives 2 types from fibers

- 1) Nucleus tractus solitarius related to taste.
- 2) Trigeminal system sensation that come from head or face (nasal and oral cavity, teeth, and skull) with some exception. Then will go to taste area (primary gustatory cortex).

From doctor: important to know anatomical term and memorize at least first eight areas in brodmann and area number 17 (primary visual area in brodmann) area number 41 42 (auditory).



GOOD LUCK <3

